Citation:

McKee LH, Neish L, Pottenger A, Flores N, Weinbrenner K, Remmenga M. Evaluation of consumable household products for decontaminating retail skinless, boneless chicken breasts. *J Food Prot*. 2005 Mar; 68(3): 534-537.

PubMed ID: 15771178

Study Design:

Randomized block trial.

Class:

A - Click here for explanation of classification scheme.

Research Design and Implementation Rating:

NEUTRAL: See Research Design and Implementation Criteria Checklist below.

Research Purpose:

To determine the effect of readily available, consumable decontamination fluids such as juices and vinegar on total aerobic (APC), total coliform (TCC) and generic *E. coli* counts on retail raw, skinless, boneless chicken breasts.

Inclusion Criteria:

Skinless, boneless chicken breasts from the meat display counter at a local grocery store near New Mexico State University in the form of individually wrapped pieces of meat on foam plates overwrapped with plastic.

Exclusion Criteria:

None specifically mentioned.

Description of Study Protocol:

Recruitment

Skinless, boneless chicken breasts from the meat display counter at a local grocery store near New Mexico State University in the form of individually wrapped pieces of meat on foam plates overwrapped with plastic.

Design

Randomized block trial.

Intervention

- Study 1: Chicken breast samples underwent a rinsing treatment in distilled white vinegar, refrigerated orange juice, apple juice, cranberry juice cocktail, 2% low-fat milk, clam juice, 10% NaCl solution, sodium bicarbonate solution, baking soda and tap water
- Study 2: Chicken breast samples were rinsed with chicken broth, soy sauce, red wine, white wine and Italian dressing
- Each chicken breast was swabbed with 10 horizontal strokes and 10 vertical strokes with a sterile sponge pre-moistened with 10 ml of sterile Butterfield's buffer. The breast was turned over and swabbed again with the other side of the sponge in the same fashion
- A V-cut was made in the swabbed end of the sample with sterile scissors and the breast was transferred aseptically to a 530ml Whirl-Pak bag containing 240ml of rinse solution. The bag was closed and shaken in a 90° arc for one minute.
- Rinsed samples were transferred aseptically to sterile aluminum foil and swabbed on the unswabbed surfaces of both sides of the meat with a second pre-moistened sponge and the V-cut as the guide
- To release bacterial cells, sponge swabs were placed into sterile Stomacher bags containing 15ml of sterile 0.1% Butterfield's phosphate buffer and mixed for two minutes at 230 rpm in a Stomacher Laboratory Blender.

Statistical Analysis

- ANOVA
- Brown and Forsythe's test for homogeneity used to test for unequal variances
- Paired T-test.

Data Collection Summary:

Timing of Measurements

- Study 1 was conducted in August 2002 and study 2 was conducted in June 2003
- Samples were purchased and immediately transported to the Food Science Laboratory at New Mexico State University, where they were assigned a number (one through 100 in study 1 and one through 50 in study 2) before being placed into a commercial refrigerator at 4°C until testing began the following day
- Immediately after removing the plastic wrap, each chicken breast was swabbed as described under the Intervention section.

Dependent Variables

Total aerobic (APC), total coliform (TCC) and generic *E. coli* counts.

Independent Variables

Readily available, consumable decontamination fluids, such as juices and vinegar.

Control Variables

Temperature and purchase location of the chicken breasts.

Description of Actual Data Sample:

- *Initial N:* 100 chicken breasts in study 1 and 50 chicken breasts in study 2
- *Location:* Food Science Laboratory at New Mexico State University.

Summary of Results:

Key Findings

- The pH values of the 10 treatment solutions from study 1 ranged from 2.53 to 8.08, whereas those from study 2 ranged from 3.40 to 6.24. Rinsing solutions were chosen to span a range of pH values and the data indicate this goal was achieved.
- The APC for breasts rinsed in distilled white vinegar (3.22 log CFU per cm^2) was lower ($P \leq 0.0062$) than for all other treatments in study 1 except cranberry juice cocktail (3.86 log CFU per cm^2)
- In study 2, APC for breasts rinsed in red wine (5.29 log CFU per cm^2) and white wine (5.32 log CFU per cm^2) were lower ($P \leq 0.0107$) than those for breasts rinsed in Italian dressing, soy sauce or chicken broth
- No differences ($P=0.4866$ for study 1; $P=0.9298$ for study 2) in before-rinsing TCC loads were detected in either study
- In study 1, after-rinsing TCC for breasts rinsed with distilled white vinegar (0.00 log CFU per cm^2) and cranberry juice cocktail (0.20 log CFU per cm^2) were lower ($P \leq 0.0383$) than for all other treatments except 10% NaCl (0.43 log CFU per cm^2) and 10% sodium bicarbonate (0.48 log CFU per cm^2)
- In study 2, few differences existed in after rinsing TCC, although chicken broth (4.48 log CFU per cm^2) was associated with higher ($P \leq 0.0318$) after rinsing TCC loads than all other solutions except Italian dressing
- Initial APC and TCC loads for skinless chicken breasts in study 2 were higher ($P<0.0001$) than for breasts in study 1 a prevented combining the data from the two experiments for statistical analysis.

Author Conclusion:

- Overall, rinsing was effective in removing microorganisms from the surface of skinless chicken breasts. This can be attributed in part by shaking. Shaking the breasts in the rinsing solutions produced both rapid solution movement over the surface of the meat as well as movement of the breast against the sides of the bag. These actions would weaken the attachment of microorganisms to the meat surface and facilitate their removal.
- Of the rinsing solutions evaluated, distilled white vinegar seemed to be the most effective.

Reviewer Comments:

Study 1 and 2 were conducted at different times with different rinsing solutions and therefore might not be comparable in effectiveness.

Research Design and Implementation Criteria Checklist: Primary Research

Relevance Questions

1.	Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (Not Applicable for some epidemiological studies)	Yes
2.	Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	Yes
3.	Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to nutrition or dietetics practice?	Yes
4.	Is the intervention or procedure feasible? (NA for some epidemiological studies)	Yes

Validity Questions

1.	**Was the research question clearly stated?**	Yes
1.1.	Was (were) the specific intervention(s) or procedure(s) [independent variable(s)] identified?	Yes
1.2.	Was (were) the outcome(s) [dependent variable(s)] clearly indicated?	Yes
1.3.	Were the target population and setting specified?	Yes
2.	**Was the selection of study subjects/patients free from bias?**	Yes
2.1.	Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	Yes
2.2.	Were criteria applied equally to all study groups?	Yes
2.3.	Were health, demographics, and other characteristics of subjects described?	N/A
2.4.	Were the subjects/patients a representative sample of the relevant population?	Yes
3.	**Were study groups comparable?**	???
3.1.	Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	Yes
3.2.	Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	???
3.3.	Were concurrent controls used? (Concurrent preferred over historical controls.)	No
3.4.	If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	N/A

3.5.	If case control or cross-sectional study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	N/A
3.6.	If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	N/A
4.	**Was method of handling withdrawals described?**	Yes
4.1.	Were follow-up methods described and the same for all groups?	Yes
4.2.	Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	Yes
4.3.	Were all enrolled subjects/patients (in the original sample) accounted for?	Yes
4.4.	Were reasons for withdrawals similar across groups?	N/A
4.5.	If diagnostic test, was decision to perform reference test not dependent on results of test under study?	N/A
5.	**Was blinding used to prevent introduction of bias?**	Yes
5.1.	In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	N/A
5.2.	Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	Yes
5.3.	In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	N/A
5.4.	In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	N/A
5.5.	In diagnostic study, were test results blinded to patient history and other test results?	N/A
6.	**Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were interveningfactors described?**	Yes
6.1.	In RCT or other intervention trial, were protocols described for all regimens studied?	Yes
6.2.	In observational study, were interventions, study settings, and clinicians/provider described?	N/A
6.3.	Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	Yes
6.4.	Was the amount of exposure and, if relevant, subject/patient compliance measured?	N/A

6.5.	Were co-interventions (e.g., ancillary treatments, other therapies) described?	N/A
6.6.	Were extra or unplanned treatments described?	N/A
6.7.	Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	N/A
6.8.	In diagnostic study, were details of test administration and replication sufficient?	N/A
7.	**Were outcomes clearly defined and the measurements valid and reliable?**	Yes
7.1.	Were primary and secondary endpoints described and relevant to the question?	Yes
7.2.	Were nutrition measures appropriate to question and outcomes of concern?	Yes
7.3.	Was the period of follow-up long enough for important outcome(s) to occur?	N/A
7.4.	Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	Yes
7.5.	Was the measurement of effect at an appropriate level of precision?	Yes
7.6.	Were other factors accounted for (measured) that could affect outcomes?	No
7.7.	Were the measurements conducted consistently across groups?	N/A
8.	**Was the statistical analysis appropriate for the study design and type of outcome indicators?**	Yes
8.1.	Were statistical analyses adequately described and the results reported appropriately?	Yes
8.2.	Were correct statistical tests used and assumptions of test not violated?	Yes
8.3.	Were statistics reported with levels of significance and/or confidence intervals?	Yes
8.4.	Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	N/A
8.5.	Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	Yes
8.6.	Was clinical significance as well as statistical significance reported?	Yes
8.7.	If negative findings, was a power calculation reported to address type 2 error?	N/A
9.	**Are conclusions supported by results with biases and limitations taken into consideration?**	Yes
9.1.	Is there a discussion of findings?	Yes

9.2.	Are biases and study limitations identified and discussed?	Yes
10.	**Is bias due to study's funding or sponsorship unlikely?**	???
10.1.	Were sources of funding and investigators' affiliations described?	No
10.2.	Was the study free from apparent conflict of interest?	???